

SMOKING MONITOR CIGARETTE PREPARATION

I. INTRODUCTION

A cigarette monitor (control) is smoked with every smoking machine analysis and is used as the control for a variety of other analyses. The monitor is the reference standard which determines whether the smoking machine performed acceptably and therefore the test sample data is valid. "Calibration" of the monitor establishes its performance level for every test parameter that uses it.

Acceptable limits are established for each smoke analysis (TPM, Nic., H₂O) according to the number of monitor ports smoked.

II. MONITOR SIZE

The quantity of cigarettes made is based on the volume of smoking performed by all of the laboratories that use it. The monitor sample should last about 18 months.

Historically, the monitor is provided by R&D to Q.A. (Richmond) and all International countries with P.M. smoking facilities. The increase in the number of International smoking laboratories each year and the increase in work load for R&D and Q.A. needs to be considered each time a new monitor is made. This influences the quantity of monitor to be made. (Example: Monitor #24 was 1,600,000 cigarettes or 807 case yield.)

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III. EQUIPMENT

- A. Electric can sealing machines (Dixie Model 23, Dixie Canner Equipment Co., Athens, GA). - 2
- B. Cans - #2 with lids
- C. Kimwipes (large) 6-8 cases
- D. Wire Racks for Cigarette Randomization - 9
- E. Folding Tables (6 ft.) - 10
- F. Chairs - 12
- G. Plastic Trash Cans (20-30 gal.) - 3
- H. Electrical Conduit Pipe (10 ft.) - 2
- I. Multi-Outlet Electrical Box (if needed)
- J. Extension Cord (if needed)
- K. Marker Pens (2-3)
- L. Duct Tape
- M. Cardboard Dividers for Wire Racks
- N. Aluminum Pans (20-25)
- O. Number Stamper and Pad Ink
- P. Oil Can (for electric canner)

IV. OBTAINING THE CIGARETTES

Historically, the high delivery monitor (about 20 mg TPM) has been a Marlboro blend. The blend used is the current Marlboro at the time the monitor is made. The two exceptions to its being a standard Marlboro are that it is never ventilated and the tipping paper length is always 27 mm to keep the smoking butt length for monitor cigarettes at 30 mm.

Monitor cigarettes are made by the R&D Semi-Works Group (Jimmy Warren) on receipt of the request that must be filled out by the CTSD. Semi-Works will obtain all needed materials, make the monitor on one making machine in one continuous operation, check and control the weight, circumference and RTD during the making process, randomly pull cigarettes at intervals throughout the process to obtain a random sample of the total population and store all of the cigarettes in magazine boxes to be delivered to a designated location.

The magazines containing the random sample of the total population are designated "Random" and are separated from the other magazines. The random sample ultimately is used to calibrate the monitor against the currently used monitor. See calibration in section XIV on page 10.

V. OBTAINING SUPPLIES

Before ordering the monitor cigarettes from Semi-Works, the cans and lids needed for the job must be ordered and received. A No. 2 can and lid is used. The estimate of cans needed is based on 82 cigarettes per can at 24 cans per case (1968 cigarettes per case).

Check first with the coordinator (Jim Dierkes) of the Shipping Warehousing Section of the Laboratory Services Group to determine how many cases of empty cans are on-hand in the warehouse. About 50 cases

of empty cans should be kept for miscellaneous use. If 200 cases are on hand, subtract 150 cases from the total quantity of cases needed to can the new monitor and order accordingly. (The number of cigarettes per case is always considered as 1968 cigarettes). Therefore, if 1000 cases are needed to can the monitor, then $1000 - 150$ cases on hand = 850 cases to be ordered.

The R&D Purchasing Group (Larry Fox) will determine the source of the cans. When the order is received, the cans will be delivered uncased and strapped on pallets. The cans are stored by the Shipping Warehousing Section coordinator until about two weeks before the canning operation begins.

At the same time the cans and lids are ordered, cardboard cases (boxes) are ordered in a quantity sufficient to package the monitor at 24 cans per case ($24,000$ cans = $1,000$ cases). The R&D Purchasing Group will determine the source of the cases. When they are received, they will be stored in the warehouse with the cans. The requisitions for the cans/lids and cases should direct that delivery be made to the coordinator (Jim Dierkes) of Shipping Warehousing. CTSD writes the requisitions for the items needed and sends them, unsigned, to R&D Purchasing (Larry Fox). Purchasing will add the vendor and cost information and return the requisitions for signatures.

VI. CASING THE CANS

The day the monitor cigarettes are completed by Semi-Works, and placed in the designated storage area, a two week equilibration period begins prior to canning the monitor. At this time, inform the coordinator of Shipping Warehousing that the cigarettes have been made and he will

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contact R&D Purchasing to obtain bids for a local packaging concern (Shipping Supplies, Inc.) to receive the pallets of cans and the cases (boxes). The contract will be for the empty cans to be put into the cases (24 cans/cases). The coordinator of Shipping Warehousing will schedule delivery of the cans and cases from the warehouse to the local concern. When the job is completed (usually about 3 days) a portion of the cases will be brought directly to the monitor canning site the Friday before the canning operation begins. Canning usually begins on a Monday.

VII. EQUIPMENT DELIVERY

By prearrangement with the coordinator of Shipping Warehousing, items A-F in Section III (Equipment) on page 2 will be delivered to the canning site (Friday). Items G-O are provided by CTSD. At this time arrangements are also made for daily pick-up of the filled monitor cases and delivery of empty can cases to the canning operation site (Measurement Development Laboratory in Semiworks). Usually a pallet of empty can cases number 90 cases. Initially three pallets and lids are placed on site. The second day of canning requires an estimate of how many pallets of empty can cases will need to be delivered the third day when pickup is made of the filled monitor cases. This repeats throughout the canning.

VIII. CANNING LOCATION

Prior to having the monitor cigarettes made, the location for storing and canning must be established. The site must be temperature and humidity controlled at $75^{\circ}\text{F} \pm 1$ and $60\% \pm 2$ R.H. and the available area large enough to accommodate the tables, cannery and personnel required to can the monitor cigarettes.

The total monitor sample is stored in the temperature/humidity controlled canning area for two weeks prior to canning to allow the cigarettes to reach equilibrium. Equilibration is determined by O.V. analysis of samples taken randomly each day from each pallet of monitor cigarettes. The first day the samples are taken from the even rows and the next day from the odd rows from each pallet. A total of 15 cigarettes is taken from each pallet every day (14 skids = 14 daily samples). The sample from each pallet is analyzed for O.V. in duplicate. Additionally each day, a random sample is taken from the bottom row only from five selected pallets. The canning operation cannot begin until O.V. analysis shows equilibration has been reached. This is usually about ten days. Three consecutive days at a stable average O.V. $\pm .2\%$ is sufficient.

During the equilibration period, the temperature and humidity conditions must be closely observed and maintained. Building Administration personnel (Carl Bosher) should be made aware of the pending monitor equilibration time and location of storage so that they can provide extra attention to maintaining the needed conditions.

IX. SETTING-UP

The incoming pallets of monitor cigarettes into the storage/canning location should be placed peripherally or to one side of the room. An area should be left open for setting up the tables and canning machines when the canning operation begins. From the equipment section (III Equipment) on page 2, it is apparent that the area must accommodate ten six-foot tables, canning machines, boxes of materials plus the empty and filled can cases. A typical table layout for the canning operation is given in Figure 1 on page 12.

X. PERSONNEL

The number of people needed to can the monitor efficiently and as quickly as possible is ten or twelve. This number of people, working all day and three hours overtime each night (about 12 hours), can complete a 1.5 million cigarette monitor in 4-5 days. Communication with Q.A. (Richard Kelly) at the time the making of the next monitor is being planned probably will result in Q.A. providing some people to help with the canning.

XI. SAMPLING/CANNING OPERATION

- A. Randomly select 10 magazines of cigarettes from the total population of magazines. Stand them on end on the tables and lean the top against a wall. Electrical conduit pipes are taped to the table top to support the cigarette magazine bottom (Figure 1 on page 12).
- B. Insert 5 cardboard dividers into the wire rack (s).
- C. From the 10 magazines, designated 1-10, fill the first compartment of the wire rack with a two-hand scoop of cigarettes (about 150) alternating between magazine 1 and 2. Fill the next compartments of the wire racks from magazines 3-4, 5-6, 7-8, 9-10.
- D. When the rack is full, remove the cardboard dividers and place the rack on the table (s) for can filling.
- E. To place cigarettes in cans, skim across the top of the rack with both hands to collect about 80 cigarettes representing several magazines.

- F. Fill the can with the cigarette filters down. When a case (24 cans) has been filled, the case is transferred to a table where the void space between the cigarettes and the can lid is filled with a Kimwipe (large) paper towel.
- G. Seal the can, using the electric can sealer, with lids previously stamped with the monitor number (Example: #24). The can seals air tight.
- H. Mark each case, using a marker pen, with the designation "Mon. #".
- I. Stack the filled monitor cases on a pallet. Interlock the case rows by alternating the case direction every other row. Stack each pallet with 6 rows and 12 cases per row (72 cases/pallet).
- J. Each morning the filled cases are picked up by Shipping-Warehousing personnel. A form called a "Cigarette Transfer Form" is supplied by them. This form requires the number of cases and cigarettes (1968 cigarettes per case), the date, and signature of the person authorized to release the cases for delivery to cold storage bonded warehouse (Southern Cold Storage) for storage.
- K. Stack the empty cardboard cigarette magazines on a pallet, interlocking the rows, and inform or deliver to Semi-Works for reuse.

XII. SECURING THE OPERATION

Upon completion of the canning operation, collapse all tables and stack them, stack the chairs, place the wire racks on the tables along with any unused Kimwipe towels and empty can cases. Return the two electrical conduit pipes and clean the area. Notify the coordinator of Shipping-Warehousing, the day before completion is certain, to arrange for pickup of all materials for return to storage. Also, retain about 25 cases of the monitor for storage in the R&D Cold Storage Room.

Verify the R&D final case count with the case count made by the coordinator of Shipping-Warehousing. The two counts must agree since this is the inventory number against which future withdrawals will be made.

XII. MONITOR STORAGE

After canning, all of the monitor is placed in cold storage at 34°F for a minimum of two weeks to kill any infestation present. The monitor is kept in cold storage. Cases are withdrawn as needed at least 24 hours prior to use to allow the cigarettes to come to room temperature. The cold storage locations are at R&D or Southern Cold Storage where space is leased by PM and service in/out is provided by the Shipping-Warehousing section.

XIV. CALIBRATION OF THE MONITOR

Testing to establish the characteristics of the monitor cigarette is performed on the randomly selected cigarettes referred to in section IV. This testing can begin as soon as equilibration is reached and while the canning is being performed.

The new monitor is tested against the monitor currently being used. The smoking, chemical and physical tests are carried out over a period of time to reflect the effect of day to day, machine to machine and operator to operator variation. For example, smoking is performed for a total of ten runs per smoking machine over a period of several weeks at different times of the day. For all tests, significantly more cigarettes are tested than normal. The various tests and the total number of cigarettes tested to calibrate the monitor are shown in Table 1 on page 13. All test data from the smoking analyses are submitted for statistical analysis and only then are any values discarded. CTSD personnel statistically evaluate all other test data.

Concurrently with R&D testing, Q.A. is provided with samples from the randomly selected cigarettes to perform smoke analyses against the currently used monitor. Generally, 3-4 cans each of the new monitor and the currently used monitor are sent to the T.I.T.L. Laboratory for testing. Only R&D data are presented in the published "Specification and Vital Statistics for Monitor #" report. The report compares the new monitor data with the data for the monitor currently in use as shown in Table 2 on page 14.

Additionally, statistical tables are developed for TPM, nicotine and water data for the new monitor which give the acceptable range per number of monitor ports smoked (Tables 3-5 on pages 15-17).

Monitor cigarettes are shipped to International laboratories only after Bob Wiley receives an approved order form (version 1 or 2) from the PMI New York Office. Authorization is then given to the coordinator of Shipping-Warehousing to withdraw the monitor from bonded cold storage for packaging and transporting to M.C. Finished Goods (Bill Meadows) for shipping. The quantity must be subtracted from their inventory total. CTSD (Ace Walker) is given a copy of the order so that the quantity can be subtracted from his inventory record. Periodically, CTSD verifies its inventory total with the total shown by Shipping-Warehousing.

COMMENT: The monitor preparation procedure described here is based on the October 1985 monitor #24 preparation.

FIGURE 1

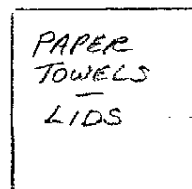
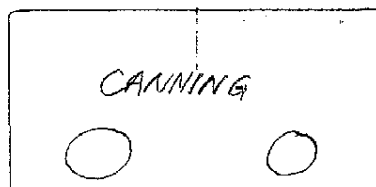
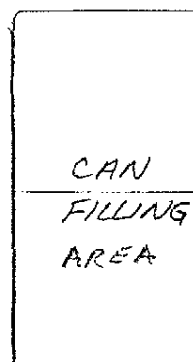
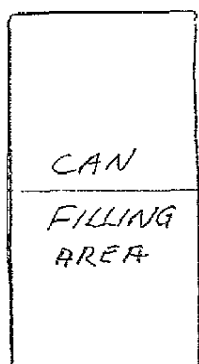
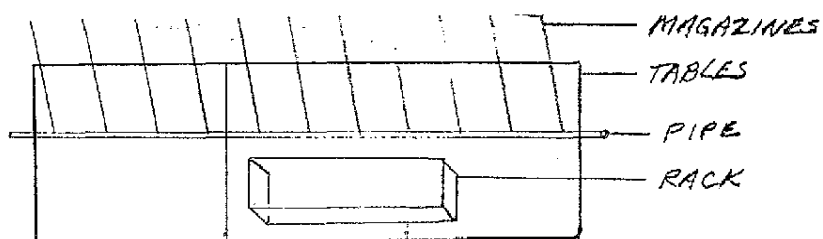


TABLE 1

<u>ANALYSIS</u>	<u>NO. TESTED</u>
A. <u>Physical</u>	
RTD, mm of H ₂ O	100
Plug RTD, mm of H ₂ O	100
Cigarette Length, mm	30
Cigarette Wt., g	500
Tobacco Weight, g	200
Circumference, mm	50
Paper Porosity, sec.	30
Rod Density, g/cc	Calculated
Plug Length, mm	50
Plug Wt., g	25
Cylinder Volume, cc/g	10
B. <u>Chemical</u>	
Paper Component, %	2
Total Alkaloids, %	16
Total Reducing Sugars, %	16
Total Ash, %	3
Glycerine, %	2
TEG, %	2
Propylene Glycol, %	2
Triacetin in Plugs, %	2
Total Nitrogen, %	2
Nitrate Nitrogen, %	2
C. <u>Smoke Delivery</u>	
TPM, mg/cigt.	100 Ports/Machine
Puff Count	100
Nicotine, mg/cigt.	50
H ₂ O in TPM, mg/cigt.	50
Static Burning Time, min.	100

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SPECIFICATIONS AND VITAL STATISTICS FOR MONITOR #23

The following are the manufacturing specifications and vital statistics for the Monitor #23 cigarettes. The cigarettes were made by the Tobacco Processing Group. The specifications for the Monitor #22 are also given.

I. <u>Specifications (Mfg.)</u>	Monitor #23 (X6-D3ARM)	Monitor #22 (X6-D1BDR)
Mfg. Date	5-11-83	6-15-81
Quantity	1,716,000	1,020,000
Brand	Marlboro 85 Special Prod.	Marlboro 85 Special Prod.
Plug Length, mm	21	21
Paper Type	Sch. 137-1	Sch. 663
Tipping paper length, mm	27	27
II. <u>Vital Statistics</u>		
A. <u>Physical</u>		
RTD, mm of H ₂ O	116	125
Plug RTD, mm of H ₂ O	71	74
Cigarette Length, mm	84.2	84.4
Cigarette Wt., g	0.992	1.002
Tobacco Weight, g	0.751	0.773
Circumference, mm	25.1	24.9
Paper Porosity, sec.	19	25
Rod Density, g/cc	0.237	0.248
Plug Length, mm	21.0	21.2
Plug Wt., g	0.137	0.136
Cylinder Volume, cc/10 g	39	35
B. <u>Chemical</u>		
Paper Component, %	0.7 Cit.	0.4 Cit.
Total Alkaloids, %	1.73	1.62
Total Reducing Sugars, %	5.3	5.3
Total Ash, %	14.1	14.4
Glycerine, %	1.8	2.1
TEG, %	0.9	0.8
Propylene Glycol, %	0.7	1.2
Triacetin in Plugs, %	8.6	7.0
Total Nitrogen, %	2.6	2.8
Nitrate Nitrogen, %	0.2	0.2
III. <u>Smoke Delivery</u>		
TPM, mg/cigt.	20.6	20.7
S.D.	1.1	1.2
Puff Count	8.6	8.5
S.D.	0.2	-
FTC Tar, mg/cigt.	16.0	16.4
Nicotine, mg/cigt.	1.16	1.03
S.D.	0.05	0.06
H ₂ O in TPM, mg/cigt.	3.5	3.3
S.D.	0.4	0.4
Static Burning Time, min.	7.9	8.0
S.D.	0.4	0.5
IV. <u>Selection</u>	Random	Random

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TABLE 3

MONITOR NO. 23 TPM

AVG. MG/CIGT. = 20.640 S.D. = 1.080

AVG. MG/PORT = 103.200 S.D. = 5.400

95% CONFIDENCE LIMITS

<u>SAMPLE SIZE</u>	<u>MG/PORT</u>	<u>MG/CIGT.</u>
1.	89.3-117.1	17.9-23.4
2.	95.7-110.7	19.1-22.1
3.	97.1-109.3	19.4-21.9
4.	97.9-108.5	19.6-21.7
5.	98.5-107.9	19.7-21.6
6.	98.9-107.5	19.8-21.5
7.	99.2-107.2	19.8-21.4
8.	99.5-106.9	19.9-21.4
9.	99.7-106.7	19.9-21.3
10.	99.9-106.5	20.0-21.3
11.	100.0-106.4	20.0-21.3
12.	100.1-106.3	20.0-21.3
13.	100.3-106.1	20.1-21.2
14.	100.4-106.0	20.1-21.2
15.	100.5-105.9	20.1-21.2
16.	100.6-105.8	20.1-21.2
17.	100.6-105.8	20.1-21.2
18.	100.7-105.7	20.1-21.1
19.	100.8-105.6	20.2-21.1
20.	100.8-105.6	20.2-21.1
21.	100.9-105.5	20.2-21.1
22.	100.9-105.5	20.2-21.1
23.	101.0-105.4	20.2-21.1
24.	101.0-105.4	20.2-21.1
25.	101.1-105.3	20.2-21.1
26.	101.1-105.3	20.2-21.1
27.	101.2-105.2	20.2-21.0
28.	101.2-105.2	20.2-21.0
29.	101.2-105.2	20.2-21.0
30.	101.3-105.1	20.3-21.0
31.	101.3-105.1	20.3-21.0
32.	101.3-105.1	20.3-21.0
33.	101.4-105.0	20.3-21.0
34.	101.4-105.0	20.3-21.0
35.	101.4-105.0	20.3-21.0
36.	101.4-105.0	20.3-21.0
37.	101.5-104.9	20.3-21.0
38.	101.5-104.9	20.3-21.0
39.	101.5-104.9	20.3-21.0
40.	101.5-104.9	20.3-21.0
41.	101.5-104.9	20.3-21.0
42.	101.6-104.8	20.3-21.0
43.	101.6-104.8	20.3-21.0
44.	101.6-104.8	20.3-21.0
45.	101.6-104.8	20.3-21.0
46.	101.6-104.8	20.3-21.0
47.	101.7-104.7	20.3-20.9
48.	101.7-104.7	20.3-20.9
49.	101.7-104.7	20.3-20.9
50.	101.7-104.7	20.3-20.9

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TABLE 4

MONITOR NO. 23 - NICOTINE

AVG. MG/CIGT. = 1.160 S.D. = .049

<u>SAMPLE SIZE</u>	95% CONFIDENCE LIMITS <u>MG/CIGT.</u>
1.	1.03-1.29
2.	1.09-1.23
3.	1.10-1.22
4.	1.11-1.21
5.	1.12-1.20
6.	1.12-1.20
7.	1.12-1.20
8.	1.13-1.19
9.	1.13-1.19
10.	1.13-1.19
11.	1.13-1.19
12.	1.13-1.19
13.	1.13-1.19
14.	1.13-1.19
15.	1.14-1.18
16.	1.14-1.18
17.	1.14-1.18
18.	1.14-1.18
19.	1.14-1.18
20.	1.14-1.18
21.	1.14-1.18
22.	1.14-1.18
23.	1.14-1.18
24.	1.14-1.18
25.	1.14-1.18
26.	1.14-1.18
27.	1.14-1.18
28.	1.14-1.18
29.	1.14-1.18
30.	1.14-1.18
31.	1.14-1.18
32.	1.14-1.18
33.	1.14-1.18
34.	1.14-1.18
35.	1.14-1.18
36.	1.14-1.18
37.	1.14-1.18
38.	1.14-1.18
39.	1.14-1.18
40.	1.14-1.18
41.	1.15-1.17
42.	1.15-1.17
43.	1.15-1.17
44.	1.15-1.17
45.	1.15-1.17
46.	1.15-1.17
47.	1.15-1.17
48.	1.15-1.17
49.	1.15-1.17
50.	1.15-1.17

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TABLE 5

MONITOR NO. 23 - WATER

AVG. MG/CIGT. = 3.480 S.D. = .440

<u>SAMPLE SIZE</u>	95% CONFIDENCE LIMITS <u>MG/CIGT.</u>
1.	2.34-4.62
2.	2.87-4.09
3.	2.98-3.98
4.	3.05-3.91
5.	3.09-3.87
6.	3.13-3.83
7.	3.15-3.81
8.	3.18-3.78
9.	3.19-3.77
10.	3.21-3.75
11.	3.22-3.74
12.	3.28-3.73
13.	3.24-3.72
14.	3.25-3.71
15.	3.26-3.70
16.	3.26-3.70
17.	3.27-3.69
18.	3.28-3.68
19.	3.28-3.68
20.	3.29-3.67
21.	3.29-3.67
22.	3.30-3.66
23.	3.30-3.66
24.	3.30-3.66
25.	3.31-3.65
26.	3.31-3.65
27.	3.31-3.65
28.	3.32-3.64
29.	3.32-3.64
30.	3.32-3.64
31.	3.33-3.63
32.	3.33-3.63
33.	3.33-3.63
34.	3.33-3.63
35.	3.33-3.63
36.	3.34-3.62
37.	3.34-3.62
38.	3.34-3.62
39.	3.34-3.62
40.	3.34-3.62
41.	3.35-3.61
42.	3.35-3.61
43.	3.35-3.61
44.	3.35-3.61
45.	3.35-3.61
46.	3.35-3.61
47.	3.35-3.61
48.	3.36-3.60
49.	3.36-3.60
50.	3.36-3.60